

## HYDROCAMPIDÆ.

## OLIGOSTIGMA INCOMMODA, sp. n. (No. 540).

Nearest to *O. curvifera* of North America. Snow-white: the primaries above crossed near the base by an angular brownish band (probably pale orange with black margins in fresh examples); second band pale orange with black margins, beginning beyond the cell in the form of a 3, the lower extremity of which is carried below the median vein to the origin of the first branch, where it turns off at an angle, and runs transversely to the inner margin; a black-edged transverse pale-orange spot closing the cell; a blackish-edged pale orange sinuated submarginal band; outer border apparently pale orange, edged internally with black scales: secondaries crossed near the base and at the middle by bands of black scales; an irregular black-edged orange discal band, its outer margin zigzag; outer border pale orange, edged internally with black. Under surface uniform snow-white. Expanse of wings 9 lines.

One female specimen so much rubbed that only familiarity with the genus enables one to trace the direction of the bands on the primaries.

## EXPLANATION OF PLATE XVIII.

- Fig. 1. *Teracolus niveus*, ♂ and ♀ (upperside), p. 177.  
 2. *Teracolus candidus* (upperside), p. 178.  
 3. *Synchloë anomala* (both surfaces), p. 178.  
 4. *Hypanis cora* (underside), p. 177.  
 5. *Acræa neobule* (underside), p. 177.  
 6. *Charaxes balfouri* (both surfaces), p. 176.  
 7. *Calysime socotrana* (both surfaces), p. 175.  
 8. *Hesperia jucunda* (both surfaces), p. 179.

3. On some Points in the Anatomy of the Koala (*Phascolarctos cinereus*). By W. A. FORBES, B.A., F.L.S., F.Z.S., Prosector to the Society.

[Received January 17, 1881.]

On April 28th of last year (1880), as already recorded in the Society's Proceedings<sup>1</sup>, the Society purchased for its collection the first living Koala (*Phascolarctos cinereus*) ever brought to Europe. The animal, a young female, continued to do well and thrive after its arrival at the Gardens, and on a diet of fresh *Eucalyptus*-leaves, which were substituted after a while for the dried ones on which it had been kept alive during the voyage and the first part of its stay in this country, became daily in better condition and more active. Being a pet animal, accustomed to being caressed, it was thought better not to put it in a cage; so a room for its use was fitted up in the Superintendent's office. Here, under the charge of a special at-

<sup>1</sup> P. Z. S. 1880, p. 355; where a woodcut of it, from the pencil of Mr. Wood, is given.



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tendant, it slept, perched upon the branches of a tree erected for its use, by day, whilst at night it wandered about the room. Very unfortunately, on the night of the 14th of June it was accidentally killed, whilst thus roaming about at night, by getting caught between the top and bottom of a fixed washing-stand, which had been allowed to remain in the room. It had apparently climbed up this and brought down on its neck the heavy lid. Nobody being near, and in spite of evidently determined struggles on its own part, it failed to relieve itself, and so was found dead in the morning from asphyxia.

The death of this animal, so unfortunate for visitors to the Society's Gardens, has given me the opportunity of putting on record some additional facts concerning the anatomy of the soft parts of this species. Mr. W. Martin, in this Society's 'Proceedings' for 1836<sup>1</sup>, has described already some of the most striking features of the animal's organization; and in Prof. Owen's 'Anatomy of Vertebrates' (vol. iii.) a few additional facts concerning it are also recorded. More recently Mr. A. H. Young has described and figured the male reproductive organs (Journ. Anat. Phys. xiii. pp. 305-317, pl. xviii.). All these anatomists, however, had only spirit-preserved specimens to work on; a few additional observations from the fresh specimen may therefore be worth putting on record, and the liver, brain, and female reproductive organs described in particular, these important parts of the system having been only imperfectly, or not at all, described by my predecessors in this field.

The following dimensions were taken on the body of the animal:—

	inches.	millim.
Total length, from tip of nose to end of body . .	17·0	432
Length of eye . . . . .	1·0	25
„ ear (greatest) . . . . .	2·15	55
„ head . . . . .	4·0	100
„ nude muzzle . . . . .	1·4	35
„ chin . . . . .	2·65	67
Breadth across muzzle . . . . .	1·0	25
„ of mouth . . . . .	1·3	33
Distance between cloaca and mammæ . . . . .	1·25	32

The tail is a mere stump above the cloaca, which latter is well defined by a well-marked circular marginal fold of the integuments. The hallux has no trace of a thumb. The skin is generally flesh-coloured; but the soles of the manus and pes, together with the naked "muffle," are black. The skin of the large and hairy ears is flesh-coloured. There is a narrow naked ring round the eyes; and the irides are brown. The pupil is a vertical oval. The nostrils are transversely oblique, the nasal septum measuring  $3\frac{1}{2}$  millims. The upper lip is split; but the split does not quite, when the surrounding parts are expanded, reach the nostrils. The skin is sparsely covered with hairs between the rami of the mandible; for nearly two inches behind it the skin is absolutely naked; and on the sides (running

<sup>1</sup> P. Z. S. 1836, pp. 109-113.

up towards the angle of the mouth) it is nearly so, a patch of black hairs being developed just behind the mouth on the lower and outer surface of this bare space.

The marsupial pouch in this young specimen is very imperfectly developed. It appears as a small, oval, nearly naked space, measuring about 0·8 inch both across and antero-posteriorly, with a well-marked bounding-fold of integument on each side; inside which is a smaller, secondary one. The hairs of the surrounding parts more or less radiate from this nude space, which lies between the epipubes (or so-called "marsupial bones"). The skin covering it is pinkish. The teats are two<sup>1</sup> in number, 15 millims. apart, and are situated at the posterior and inner angles of the bounding-folds; they are covered by fur. The lips of the pouch, it may be noted, look as much downwards as forwards.

In an adult ♀ Koala, 20½ inches long, preserved in spirit, the pouch is much better developed—its antero-posterior extent being about 1·85 inch, whilst the breadth of the aperture is 1·4 inch. It admits (my) three median fingers, and extends widely outwards into the groins, as far as the skin-fold between the knee and trunk. The teats, two in number, are situated behind, on a level with the posterior margin of the pouch's mouth. The skin lining the pouch, except just around the ventral opening of the pouch, is smooth throughout.

The mucous membrane of the cheeks is smooth throughout; the skin is attached to the gum opposite the first palatal ridge, and again opposite the posterior border of the first premolar. Between these two attachments there is formed a sort of cheek-pouch, defined by a distinct sphincter, and capable of receiving the end of the little finger. This pouch extends upwards on the side of the skull, occupying the somewhat oval space that exists, in the macerated skull, in front of the zygoma; it is lined by smooth, white, mucous membrane<sup>2</sup>.

The palate presents 9 irregular raised ridges, best marked anteriorly. There is no uvula, and the narrow fauces are smooth. The tongue quite fills up the space between the gums. It is parallel-sided and elongated, but rounded off and thinner in front. It has a single, small, circumvallate papilla behind; the fungiform papillæ are distributed chiefly along the sides of the upper surface.

The salivary glands are well developed. The sublingual (which is not mentioned by Martin in his description) is a long, narrow, and thin gland, somewhat foliaceous at the extremity, and about 2·7 inches in extent, lying deeply along the inner margin of the lower jaw. The long duct of the submaxillary gland pierces it. I could find no subzygomatic gland, as described by him (*l. c.* p. 112).

On opening the abdominal cavity the stomach is visible in the

<sup>1</sup> Prof. Owen (*Anat. Vert.* iii. p. 769) describes *Phascogale* as having four ["two on each side"] mammary glands.

<sup>2</sup> These pouches are also, I find, described by Owen (*Anat. Vert.* iii. p. 385). They also exist, though less well defined by a sphincter, in the Wombat; but I cannot find them in the other Phalangers I have examined.



epigastric and left hypochondriac regions, the pylorus being directed towards the right side; and it is there in contact with the gall-bladder. The liver does not appear. The commencement of the transverse colon is visible, running downwards towards the left, below, but parallel with, the greater curvature of the stomach. The great omentum is attached to the transverse colon in the right hypochondrium, and does not cover the mass of the viscera. The greater part of the rest of the abdominal cavity is occupied by the great, longitudinally plicated, folds of the cæcum and cæcum-like ascending colon, a few folds of the small intestine appearing between the transverse colon and a great fold, apparently the cæcum, which runs transversely across the middle of the abdominal cavity. On turning back these great superficial folds the end of the cæcum is seen passing downwards to the left of the rectum, behind the uteri and bladder, to terminate, deep in the pelvic cavity, close to the cloaca! The descending colon, which is narrow and of the ordinary appearance, is very long, and is arranged on a broad mesocolon to the right of the vertebral column, forming here a series of loose loops, which, however, are not closely coiled together on each other as in Ruminants. The right kidney lies superficially to the liver. The duodenal loop passes downwards and to the right, and overlies the right kidney, but passes under the ascending colon just here.

The stomach is cylindrical and sac-like. Its length, moderately distended, is about  $3\frac{1}{4}$  inches; its greatest depth, opposite the pyloric constriction,  $1\frac{1}{2}$  inch. There is a well-marked cardiac fundus to the left of the œsophagus, and the pyloric part is slightly bent on the cardiac part; this latter is marked off internally by a distinct fold of the mucous membrane, which is smooth and pale, with some slight traces of rugæ in the cardiac fundus.

The most marked peculiarity of the Koala's stomach is its possession, as is well known, of a special gland-patch, similar to that found in the Beaver<sup>1</sup> and Wombat<sup>2</sup>. This gland-patch forms a slight elevation externally on the lesser curvature of the stomach, just on the pyloric side of the entrance of the œsophagus. It is somewhat saddle-shaped, with a transverse extent of 1·4 inch. Internally it forms an eminence about the size of a florin, which includes the entrance of the œsophagus. The mucous membrane on the gland-patch, around the entrance of the œsophagus, is red and vascular; elsewhere in the stomach, as already stated, it is quite pale. The openings of the gland-patch are about 30 in number, of varying sizes, and irregularly arranged over the eminence. Some of the openings of the gland are complicated, several smaller openings debouching into a larger one; and the area occupied by the openings is not symmetrical. The general appearance of this patch is well represented by Sir Everard Home's figure (*l. c.*) of that of the Wombat. In this latter animal the general structure and form of the stomach are also very like that here described; but it is more

<sup>1</sup> *Cf.* Owen, *Anat. Vert.* iii. p. 422.

<sup>2</sup> Home, *Phil. Trans.* 1808, p. 307, pl. ix.

globular, and therefore less cylindrical in shape, the cardiac and pyloric openings being more approximated.

The small intestine is villous, but otherwise smooth. It is not sacculated, and when spread out, after being cut, is 0·5 inch across. At its commencement it is dilated for about two inches; there are no Peyer's patches; its length is 115 inches. The large intestine is very peculiar: for the first  $28\frac{1}{2}$  inches or so of its length, which forms the ascending colon, it is very capacious, and internally longitudinally corrugated, like the cæcum, which externally it much resembles, the rugæ of the interior appearing through the walls of the intestine, and giving it a longitudinally striated appearance. These folds of the mucons membrane, which might be called longitudinal *valvulæ conniventes*, where best developed are about ·2 inch in depth; they are arranged longitudinally and are roughly parallel, though somewhat irregular in extent; they are separated from each other by intervals of about the same extent (0·2 inch). At the commencement of the colon, which here, when cut open and spread out, is 3·75 inches broad, and of the cæcum, there are about a dozen of these folds very well marked. These continue throughout the ascending, cæcum-like, colon; but where it narrows to form the transverse and descending parts they converge, and become more or less blended with each other, forming linear elevations. They are continued downwards as far as the rectum, but are reduced by that time to five<sup>1</sup>. In the cæcum, which is also very capacious, the same arrangement of folds obtains till within 18 inches of its apex, when they gradually disappear, the rest of the organ being thence onwards quite smooth internally. The cæcum, the curious position of the *caput* of which has already been described, measures 46·75 inches in length (nearly three times the length of the animal's body!); the large intestine 93·25 inches. In an adult female ( $20\frac{1}{2}$  inches long), preserved in spirit, the following were the intestinal measurements:—

	inches.
Small intestine .....	111·15
Large „ .....	160·8
Cæcum .....	66·0

Owen (Anat. Vert. iii. p. 420) gives 92, 125, and 77 inches respectively. On each side at the junction of the ileum and colon is a small patch of three glands.

The liver of the Koala is of very remarkable form. It is repre-

<sup>1</sup> Mr. Martin describes (*l. c.* p. 111) both colon and cæcum as sacculated "by a slight longitudinal (mesenteric) band of muscular fibres," with indications of a similar opposite band. I could find no traces of any such sacculation in the fresh Koala examined by me; nor are they mentioned by Prof. Owen (Anat. Vert. iii. p. 418). It is also to be noticed that Martin does not in any way allude to the existence of the very remarkable folds of the interior of the cæcum and colon.

In *Phalangista* and *Phascalomys* an examination of fresh specimens has completely failed to exhibit any traces in either cæcum or colon of the longitudinal folds here described. In the latter genus the colon is capacious at its commencement, and sacculated transversely, in a way that does not obtain in either *Phalangista* or *Phascolarctos*.

sented, drawn to scale of  $\frac{3}{5}$  the natural size, in the accompanying figures (1 and 2, pp. 186, 187). All four principal lobes are well developed; but those on the right are far larger than those on the left, the left central being considerably the smallest of these. The umbilical fissure is distinct, extending about halfway across the liver. The right central lobe, which is broad transversely, and forms the largest lobe, is divided very deeply by the large cystic fissure, which extends on the thoracic surface nearly as far back as the umbilical one, and allows the very large and elongated gall-bladder to appear above. Both right and left lateral fissures are also (in this specimen) well developed. The right lateral lobe is large and somewhat oval in shape, but pointed below. The caudate is not present as a free structure, but it is represented by a somewhat squared, diagonally strided elevation, lying to the right of the inferior *cava*, and broadly attached to the substance of the right lateral lobe. The lower border of this elevation is slightly excavated to receive the corresponding kidney. The Spigelian is represented by a smaller thickening, ending in a pointed and free apex, and lying to the left of the *vena cava*; it is united over this by hepatic tissue to the caudate. This liver is further remarkable for the great tendency it has to subdivision, numerous fissures, of varying sizes and depths, being developed along the margin of the chief lobes. Their position and relative size will be better understood from the figures than from any verbal description. They are more conspicuous on the visceral than the thoracic surface. The right half of the right central lobe has one such notch on its right external border; the other half 3, on the right internal border; the left central has 4, the left lateral 3, whilst the right lateral is still more cut up by about 10. Finally, the caudate has 3 of these supplementary fissures.

The gall-bladder is remarkably long, projecting far beyond the anterior margin of the liver, and, as already described, appearing superficially. It is  $2\frac{3}{4}$  inches long from its apex to the commencement of its duct opposite the anterior margin of the left central lobe. The free part is connected by a peritoneal investment to the sides of the cystic fissure.

In a second liver of *Phascolarctos* examined (which, however, having been extracted from a spirit-preserved animal, an adult ♀, is not so well preserved as might be wished) the same general features obtain. The left lateral fissure, however, is less distinct, as is the caudate; and the left central lobe is smaller proportionally to the left lateral. The Spigelian wants the pointed apex; and the development of secondary fissures seems to attain an even greater extent<sup>1</sup>.

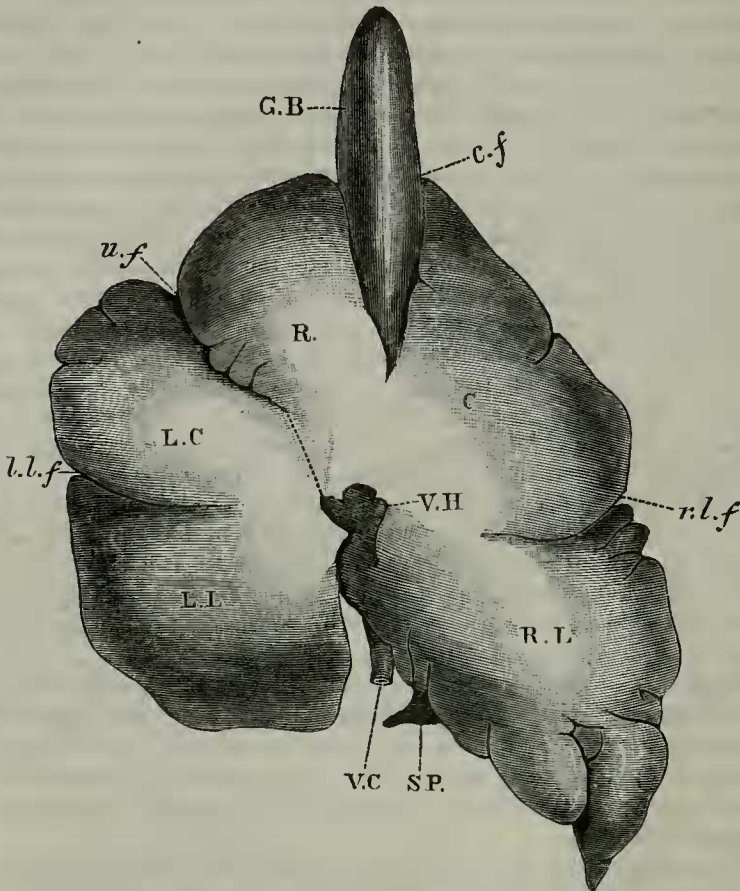
<sup>1</sup> In *Phalangista vulpina* the right central lobe is also, as in the Koala, the biggest, and very deeply divided by a cystic fissure. The gall-bladder, however, does not nearly reach the margin of the liver; the left lateral lobe is much bigger than the right lateral, which is as large as the left central; the caudate is quite free and narrow. All the lobes are remarkably distinct; and their margins are quite simple, with no trace of any such fissures as obtain in the Koala.

The liver of *Cuscus maculatus* is formed on a similar principle, though the right central lobe is not bigger than the left lateral, and the gall-bladder reaches to the liver-margin. All the lobes are simple. The caudate and Spigelian,



The bile- and pancreatic ducts open into the duodenum  $2\frac{1}{2}$  inches from the pylorus. The pancreatic duct is dilated terminally into a vesicle, which does not receive the bile-duct, the latter opening alongside the former into the intestine.

Fig. 1.



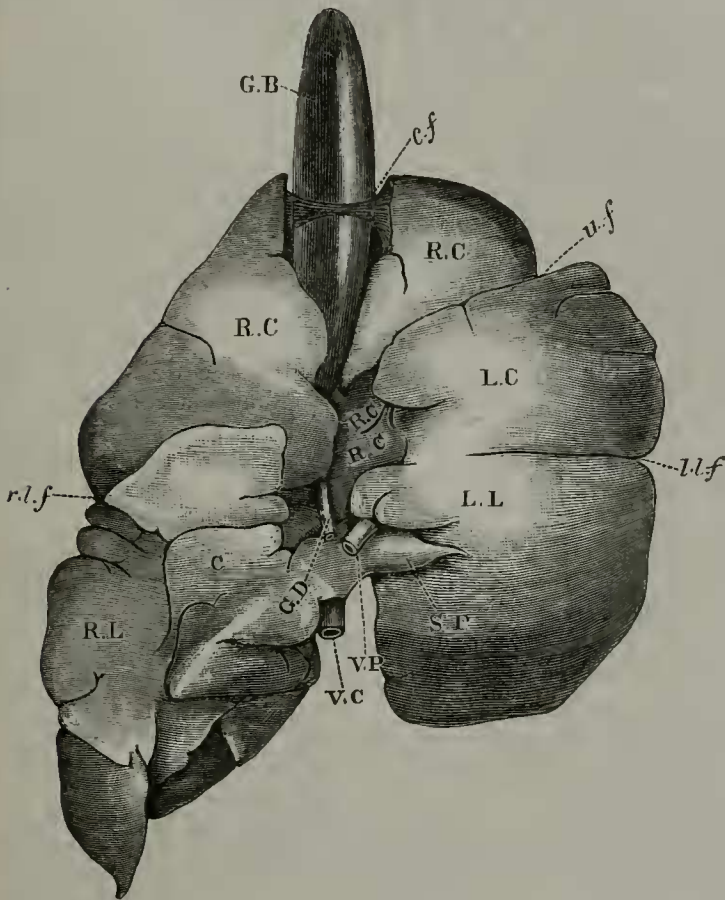
Liver of Koala, from above; three fifths the natural size.

though small, are quite distinct. The livers of *Belideus sciureus* and *B. breviceps*, *Acrobata pygmaea*, and *Dromicia (nana?)*, though differing among themselves considerably in the relative degree of development of their constituent lobes, all agree in having a distinct and free caudate lobe, as well as a Spigelian, and in no system of secondary sulci attaining any degree of development.

In *Phascolomys wombat* the left lateral lobe is the largest; the right central is also large; but the left central is very small, as is the right lateral fissure. The umbilical fissure is distinct, as is the cystic fissure, which allows the gall-bladder, which reaches to the anterior margin of the liver, to appear superficially. There are no distinct caudate or Spigelian lobes, though the former is indicated. There is a tendency, particularly on the left lateral and right central lobes, to develop accessory sulci. As in the Koala, too, the small right lateral lobe is pointed below.

The spleen, as usual in Marsupials, is somewhat triradiate in shape, being broader and forked at one end, tapering and more pointed at the other. Its greatest length is  $2\frac{1}{4}$  inches. There is a lymphatic gland, the size of a pea, outside each marsupial bone,

Fig. 2.



The same, from below.

*R.C.* Right central lobe; *L.C.* left central lobe; *R.L.* right lateral lobe; *L.L.* left lateral lobe; *C.* caudate lobe; *S.P.* Spigelian lobe; *G.B.* gall-bladder; *G.D.* bile-duct; *r.l.f.* right lateral fissure; *l.l.f.* left lateral fissure; *u.f.* umbilical fissure; *c.f.* cystic fissure; *V.C.* vena cava inferior; *V.P.* vena portæ; *V.H.* hepatic vein.

and a pair of similar ones, superficial, on the neck. The axillary glands are large.

The heart is of the usual Marsupial type. The right auriculo-ventricular valve is membranous, and nearly complete all round the aperture, being largest on the right side. It is attached to two, or,

in one of my specimens, three *columnæ carneæ*, which also decrease in size from right to left. On the side corresponding with the septum the valve is attached, not to a *columna carnea*, but by *chordæ tendineæ* inserted on the septal wall. There is apparently only a single opening for the coronary veins, just at the entrance of the *inferior cava* into the auricle.

The aorta gives off, in the specimen which died in the Society's Gardens, three vessels from a common trunk, and then the left subclavian, as in *Phalangista* and most other Marsupials<sup>1</sup>. In another specimen, however, the arrangement is as in Man and as in *Phascolomys*, the left carotid arising independently from the aortic arch. Of the two *venæ azygos*, each opening into the superior cava of its side, the *left* is much the larger, the right being formed mainly by vessels derived from only the first few intercostal spaces, whilst below these the veins of the right side pass over, behind the aorta, into the *left azygos*. This is an arrangement I have found in several Marsupials examined, including *Phascolomys*, *Belideus*, *Cuscus*, and *Phalangista*, though not in *Petrogale* or *Hypsiprymnus*. In *Phascolomys* there exists a commissural branch between the first intercostal vein on the right side going to the left, and the last going to the right, *vena azygos*. In the Hedgehog, and some other animals according to Prof. Owen (Anat. Vert. iii. p. 553), the right is also smaller than the *left azygos*, though usually the reverse condition holds; and in the highest forms, where there is only *one vena azygos*, it is the *right* that persists.

The external and internal iliac arteries come off separately from the aorta, there being no common iliac arteries. This disposition is, I believe, nearly universal<sup>2</sup> in the Marsupials, but is by no means confined to them, as I have found it in *Tamandua*, *Tapirus*, and *Hyomoschus*, and Prof. Watson records it in *Hyæna crocuta* (P. Z. S. 1879, p. 89).

The lungs are simple in form. The right side has three, the left two lobes; the lower lobes of each side being about equal in size, and much larger than the others—half as big again as the upper, or two upper, lobes. There is no azygos lobe at all.

The female generative organs of *Phascolarctos* have not been, so far as I have been able to ascertain, hitherto described, though Mr. A. H. Young has lately given us an excellent account, with figures, of the corresponding system in the male. In their essential points they differ in no important respect from those of the Wombat<sup>3</sup>.

<sup>1</sup> P.S. Feb. 11, 1881. In a fresh specimen of *Belideus breviceps*, which I have just dissected, I find only *one* trunk arising from the aortic arch; this splits up into 3 branches—a left innominate, dividing into the subclavian and carotid branches for that side, a right carotid, and a right subclavian. Moreover, as in no other Marsupial known to me, there is only one anterior cava, the right and left innominate veins joining to form a larger trunk, some  $\frac{1}{2}$  inch long, which opens into the auricle.

<sup>2</sup> In a *Cuscus maculatus* that I dissected I found the abdominal aorta splitting up into four trunks, the right and left external, and the right internal iliacs, whilst from the remaining or median (caudal) one, the *left* internal iliac was given off some way below the level of the other.

<sup>3</sup> For description of these see Owen, P. Z. S. 1836, p. 52, and Anat. Vert. iii. p. 680 *et seq.*

The ovaries are rounded ovals in shape, considerably depressed, and measuring about  $\cdot 45$  inch along their greatest extent. They are cut up by three or four sinuous fissures; each of these lobes is further subdivided into ovisacs, which are of large size for a Mammal, though nothing like so big as the large ones figured by Prof. Owen in *Phascolomys*. The ovaries are enveloped to some extent by the fimbriated ends of the Fallopian tubes, and are enclosed, in common with these, in pouches of delicate peritoneum. The fimbriated ends of the oviducts are attached narrowly to the posterior part of the ovary; they extend hence for about  $0\cdot 5$  inch to the *ostium abdominale*.

The Fallopian tubes are little bent, and are of small calibre, passing gradually into the larger, somewhat fusiform uteri, which, as usual in the Marsupials, are quite separate from each other; muscular, thick-walled, and nearly straight, these open on a prominent, somewhat compressed nipple-like eminence, forming the *os tincae*, by a small pore. The total length of the Fallopian tubes and uteri is about  $1\cdot 3$  inch from the *ostium* at the commencement of the former. The vaginæ are also two in number, each being bent outwards in a simple curve, and not communicating with its fellow at any point. The lower part of each vagina is thick-walled, with but a small central cavity, which opens into the urino-genital sinus by a small pore,  $0\cdot 2$  inch above the opening of the vesical urethra. Above they are thin-walled; and from the internal side is developed a blind *cul-de-sac*, also thin-walled, communicating only with the vagina of its own side and the corresponding uterus, there being a median septum between the two *culs-de-sac*. No opening from the latter into the urino-genital sinus exists in either specimen I have examined. From the *os tincae* there is prolonged downwards on each side a slightly elevated fold of the mucous membrane, which separates off the vagina proper from the more medianly placed *cul-de-sac*.

Both vaginæ and *culs-de-sac* are lined by smooth mucous membrane, with slight longitudinal rugæ. The two uteri, as well as the vaginæ and their *appendices*, are united together by peritoneum. The two ureters penetrate this to open into the neck of the bladder, beyond the termination of the vaginal *culs-de-sac*. The length of the vaginæ is about  $0\cdot 65$  inch, measured in a straight line; that of the *culs-de-sac* about  $0\cdot 45$  inch.

The urino-genital sinus is a tube, with moderately thick walls and longitudinally plicated mucous membrane, of  $1\cdot 3$  inch in length. It communicates below by a considerable aperture with the rectum, and the cloaca so formed is surrounded by a common fold of muscles and integument. A small, flattened, linguiform clitoris, not free at its apex, with two grooves above and about  $0\cdot 2$  inch long, is developed on the anterior wall of the cloaca, beginning at the level where the rectum and urino-genital canal meet.

A second specimen examined—an adult female that has been preserved in spirit, and which, judging from the condition of its mammae, has been a mother—shows exactly the same relations of these parts as that here described, the only differences being in the sizes of



some of the parts, due, no doubt, to age. The clitoris, however, is free at the apex and slightly bilobed<sup>1</sup>.

The brain of the Koala is represented of the natural size in the accompanying figures (figs. 3-6), of which that representing its superior aspect was taken from the brain before being removed from the cranial cavity, and therefore unaltered by displacement or hardening in spirit. The other three figures are drawn from the brain after hardening in alcohol for some months.

The cerebral hemispheres are remarkable for their simple surface, which is broken up by no convolutions. Broadest behind, they taper forwardly, and so are somewhat pyriform in outline when viewed from above. They leave the *corpora quadrigemina* largely exposed behind; and in consequence the cerebellum is left entirely uncovered: indeed, when the parts are undisturbed (fig. 3) it is not even in contact with the cerebral hemispheres. The greatest length of the cerebral hemispheres is about 1·2 inch; their greatest depth about 0·7 inch. Viewed from the side, their superior contour is seen to be but little arched behind, whilst anteriorly it slopes downwards away rather suddenly towards the olfactory lobes. These last are not large, and but little exposed; in fact, in the undisturbed state, they are covered, when viewed from above, by the hemispheres. The temporal lobe is small. Superiorly the hemispheres, save for a few slight vascular impressions, are altogether smooth; laterally, a well-defined sulcus, running from the temporal lobe forwards, and curved, first upwards and then downwards, is visible. Anteriorly, this separates off the olfactory tract from the side walls of the hemispheres. A slight indentation, about halfway along its course, at the top of its upward convexity, may represent a rudimentary Sylvian fissure. Just behind this is a second similar, though smaller, impression. The olfactory ganglion is large, as is the tract. Internally, the characteristic features of the Marsupial brain<sup>2</sup> are distinct, the corpus callosum being small and indistinct, and the anterior commissure very large. The hippocampal sulcus is distinct and

<sup>1</sup> In *Phascolomys wombat*, in a two-thirds grown female, I can detect no differences of importance whatever from the type here described. The Fallopian tubes are apparently longer, and their fimbriated extremities better developed. The form of the ovaries, and the disposition of the uteri, vagina, and urinogenital sinus seem to be nearly precisely similar in the two genera.

In *Phalangista vulpina*, on the other hand, considerable differences occur. The Fallopian tubes are shorter in proportion to the uteri, and are more convoluted. The uteri are more distinct from the Fallopian tubes, are more capacious, and strongly curved outwards. Each *os tincæ* projects as a prominent and quite free papilla into a common vaginal chamber, formed by the coalescence and fusion of the two *diverticula* present in *Phascolomys* and *Phascolarctos*. This chamber is capacious, and has only a very slight indication of a median septum left.

In *Belideus sciureus* the Fallopian tubes and uteri resemble those of *Phalangista*. The vagina, however, are much longer and curved on themselves, much as in the Kangaroos. There are apparently two small *culs-de-sac*; but the specimen examined does not allow me to say whether or no they unite. In *Petaurus* (= *Belideus*?), according to Owen (Anat. Vert. iii. p. 682), where the vaginae are also long and curved, the *culs-de-sac* remain separate.

<sup>2</sup> Vide Flower, Phil. Trans. 1865, p. 647.

Fig. 5.



Fig. 4.



Fig. 3.



Fig. 6.

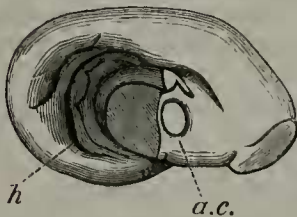


Fig. 3. Right half of Koala's brain, from above, of the natural size; drawn before removal from the skull.

Fig. 4. The same, from below.

Fig. 5. The same, from the side.

Fig. 6. Left cerebral hemisphere, from the inside, the optic thalamus being cut short. *a.c.* anterior commissure; *h.* hippocampal sulcus.

deep, strongly curved, and continued forwards over the corpus callosum onto the internal face of the hemispheres to a point about 0·15 inch in front of the anterior commissure. Behind is another rather deep, *f*-shaped sulcus, which appears at both ends on the prominent rounded margin of the hemispheres. The *corpus fimbriatum* and *fascia dentata* are both distinct. The middle (grey) commissure is very large. Of the *corpora quadrigemina*, the *nates* are longer (from before backwards) than the *testes*. The posterior limb of the crucial impression is not as distinct as the fore one.

In the cerebellum the vermis is well-developed, as are the lateral lobes and the *floculi*, which have the form of projecting, rounded lobes. The *pons Varolii* is narrow, the anterior pyramids well-defined, and the *corpora trapezoidea* distinct.

As compared with *Phascolomys*, the principal points of difference in the brain are the more richly convoluted hemispheres—a distinct *calloso-marginal* sulcus being present, as well as others on the external surface—and the non-projecting *floculi*, of the latter. *Phalangista* has nearly as simple a brain as the Koala; but the *floculi* project more.

A consideration of some of the facts on the visceral anatomy of the Koala here stated appears to me to throw considerable light on the classification of the Marsupials. Naturalists generally have placed the Koala in, or close to, the *Phalangistidæ*; whilst the *Wombats* have been retained as a separate family or section, of equal value with the former group, the *Kangaroos* being often, indeed, interposed between the two<sup>1</sup>. Writing as long ago as 1846, Mr. G. R. Waterhouse, in his 'Natural History of the Mammalia' (vol. i.), though in that work keeping the *Phascolomyidæ* separate from the *Phalangistidæ*, evidently did so with some hesitation. He says (*l. c.* p. 16):—"Upon a careful examination of the *Wombat*, I find so many points in common with the *Phalangista* group, that it is so intimately connected with the Koala (which is more clearly an aberrant *Phalanger*), as indicated by the structure of the stomach and the deficiency in the number of the false molars, and the total absence of tail, that I am inclined to regard the genus *Phascolomys* as presenting an aberrant form only of the *Phalangistidæ*. That the thumb should be reduced to a small size in this animal, which differs from others of its (supposed) family in living upon the ground, I am prepared for, since in the *Dasyuridæ* the same thing takes place under similar circumstances. I am also prepared to find in an herbivorous group like the *Phalangistidæ* a difference in the structure of the molar teeth, in having them rooted in one case and rootless in another, for such happens in other herbivorous groups of the *Mammalia*." Again, in a note on p. 257:—"With regard to the position of the *Wombat* and the Koala (*Phascolarctus*) in a natural system, I may observe, in the first place, the *Wombat* (*cæteris paribus*) shows some affinity to the *Phalangistidæ* in the possession of a thumb, which, though short, is very broad and sufficiently distinct. Then, beyond this, we have to add that the

<sup>1</sup> Cf. Owen, "Classification of the Marsupialia," P. Z. S. 1839, p. 19; Selater, Rev. List of Vertebrata, 7th edition, 1879.

limbs are equal, the tibia and fibula are widely separated, excepting, of course, at the extremities; and the stomach is simple<sup>1</sup>, as in the *Phalanger* group. On the other hand, we perceive in the Koala an animal possessing all the essential characters of *Phalangista*, but in which the stomach is provided with a peculiar glandular apparatus, and the tail is wanting, as in the Wombat. The two animals agree, moreover, very closely in the structure of the humerus; they agree in the non-possession of a patella, in the absence of a *ligamentum teres*<sup>2</sup>, and in the outermost of the articular surfaces of the upper extremity of the tibia being continuous with the articular surface of the fibula. The skull of the Koala, as compared with that of a typical *Phalangista*, differs in having the posterior palatine openings confined to the palatine bone, which is also the case in the Wombat; the lower jaw differs in the greater extent of the symphysis menti; and, lastly, an approximation to that Rodent-like type of dentition which is exhibited by the Wombat is perceptible in the Koala, in the smaller development of the posterior incisors and canines of the upper jaw, and the total absence of any of those premolars which, in the typical *Phalangers*, intervene between the canine and the five molars of the upper jaw, and the incisor and the corresponding teeth in the lower jaw." Dr. Murie, from his examination of the osteology of the Wombats (P. Z. S. 1867, p. 815), appears also to incline to Mr. Waterhouse's view.

In the course of this paper I have already noted several other points of resemblance between the Koala and Wombat, in the presence in both of more or less distinct cheek-pouches, in the absence of a distinct caudate lobe to the liver and the tendency of its lobes to develop additional superficial sulci, and, finally, in the structure of the female reproductive organs. In the Wombat, too, the first traces of the *syndactyle* condition of the pes appears, both externally and also in the structure of the bones. But, to my mind, the most convincing token of their affinity is their possession of the peculiar gastric gland<sup>3</sup> already referred to and described. In no other Marsupial is there any trace of such a structure visible, whilst in the two forms under consideration its identity is almost precise. That such a unique structure should have been independently developed in two forms unrelated to each other appears to me to be in the highest degree improbable.

The main points of divergence from the *Phalangers* presented by the Wombat are the peculiarities of its dentition, and its extra-

<sup>1</sup> I suppose by this is meant as opposed to the sacculated stomach of the Kangaroos.

<sup>2</sup> As regards these last two characters, it must be observed that the first is a character practically common to all Marsupials, excepting the Peramelidæ (cf. Flower, 'Osteology of Mammalia,' 2nd ed. p. 306). As regards the alleged absence of a *ligamentum teres*, I find it perfectly well developed in fresh specimens of both Koala and Wombat; on the femur the depression for it, though not distinct, is traceable.

<sup>3</sup> It would be interesting to investigate the histological structure of this gland, with the object of determining whether or not the resemblance is more an external.